Detailed country profile

FIJI

Local Building Cultures for sustainable and resilient habitats

INTERNATIONAL FEDERATION

CRAterre ENSAG

LABEX AE&CC

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Communauté Université Grenoble Alpes

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Cover images (from top to bottom):

Traditional bure house (©Vaughn);
Transitional timber house (©culturevixen.com);
Formal timber house after 2015 cyclone Winston (©unicef).

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1. Introduction

1.1. Why promote Local Building Cultures

All over the world, **societies have always been able to produce, adapt and develop their habitat**, according to their needs, interests and abilities, making the best use of locally available materials. The strategies developed to take advantage of natural resources and, at the same time, protect populations from the destructive forces of nature, have generated rich and varied knowledge at local levels.

(Re)discovering the intelligence of local architectures through their analysis and the analysis of the associated practices is mandatory. It will contribute to the creation of disaster resistant architectures in tune with contemporary lifestyles and their evolutions, **respectful of the local environment and culture**, and adapted to the technical and economic capacities of local populations.

Relying on local knowledge, know-how, construction organization and traditional means of transmission turns out to be **very effective** with regards to:

- The implementation of **solutions well adapted to inhabitants ways of life** and the suggestions of improvement answering their needs thanks to a strong involvement of local populations in the projects. This allows for a **strong short and long-term appropriation** of the projects by inhabitants.
- The possibility to **shelter many people quickly and cost-effectively** while taking seasonality effects into account.
- The **large-scale reproducibility of the improvements** designed in continuity with local building cultures and an easy access – both financially and technically – to the promoted solutions for non-beneficiaries.
- The **positive impact on local economy** as local skills and materials are fully promoted.
- The empowerment of inhabitants and the **improvement of their resilience**.

The final aim of this approach is to develop a **disaster-resistant architecture adapted to current local ways of life**. This includes an adaptation to the environmental, cultural and social specificities of inhabitants and to their **technical and financial abilities**.

It is important to invest in **inhabitants and local professionals' empowerment** at the very beginning of the recovery phase. Promoting repairs may help reaching this goal. Empowering people is a major contribution to **leveraging the project effects and to strongly connecting relief, rehabilitation and development**.

Inside a Bure in Haragayato.

(©wikimedia commons)

1.2. Key concepts

Building cultures

A building culture is the intangible dimension of a construction (or a compound) produced by humans to settle, work, thrive etc. and strongly connected with its environment.

It includes elements related to each phase of the building life cycle: design, construction, uses, maintenance, replacement etc. These elements may be related to social, economic and environmental aspects as well as cultural aspects – including symbolic and representations systems.

The building cultures genesis and evolutions are closely linked to their environment and to the specific history of each places. This is the reason why they are so diverse all across the world and why they can differ in a very same place.

Vernacular habitat

Vernacular habitat is characteristic of a geographical area. It usually results from the use of local resources without the intervention of architects. It is closely linked to the place in which it is built. According to Pierre Frey[1], distinctive features of vernacular habitat are: its construction outside or on the outskirts of global economic flows; its production process – mainly handmade – which allows for the re-establishment of the links between the inhabitants and their habitat and more specifically their feelings of belonging and of recognition. This habitat results from reproductions, improvements and on-going adjustments. It does not exclude external inputs and imported solutions.

Precarious habitat

The term "precarious habitat" covers very different realities depending on the specificities of the places and the factors that generate it: economic difficulties, climate change, natural disasters or armed conflicts. It characterizes houses or shelters built by low-income families or who, without land title, prefer to limit their investment with in some cases the choice of light structures, easy to move. These constructions are often gathered within huge peripheral urban areas and access to essential networks and services varies greatly. Often constructed outside the legal and administrative frameworks, precarious housing has also limited access to satisfactory sanitary standards and a negative perception for the community, which can no longer benefit from the use of the occupied spaces.

However, the populations concerned often show a strong attachment to these habitats. Indeed, beyond their intrinsic defects, conceived and built by the populations themselves, they often result from a very clever use of local resources to meet certain minimum needs, adapted to their way of life. Beyond that, it is not uncommon for the latter to include elements of comfort, income generating uses or external spaces of socialization that do not exist in more formal realizations.

Globalized habitat

Constructions induced by "global" and "ready-made" solutions, mostly built with industrial building materials.

[1] Frey P., 2010, Learning from vernacular, pp45-51

1.3. Methods used for data collection

A. Data collection

This document was elaborated after a **dedicated literature review** (see chapter 7) and thanks to the **capitalization of feedbacks** from the previous experiences of the authors and their partners in (name of the country).

The data included in this document are not exhaustive. Its user is responsible for checking and completing this information according to his/her specific working area.

B. Publication history

First edition: **march 2016** after Cyclone Winston.

Second edition: **september 2017.**

1.4. Instructions for use

CRAterre and its partners have been working for several years on the elaboration and the diffusion of a **local building cultures identification method, especially with regards to their contribution to Disaster Risk Reduction**. This work aims at facilitating the identification of their strengths and weaknesses and of the opportunities they offer, in order to promote them – in an adapted version if necessary – in habitat reconstruction or improvement projects.

This document was elaborated at the occasion of this research project. It introduces **reference data on local building cultures and local sociocultural resilient strategies** that should be considered when designing and implementing habitat or DRR projects.

It aims at helping stakeholders in **identifying the strengths and weaknesses of local buildings and in raising awareness** among their partners.

This factsheet is to be considered as a **basis for the elaboration of project-specific strategies**. It must be completed by f**ield surveys** to exchange with local actors and by **further research on the working area specificities.** The potentials and stakes deeply differ from a place to another and stakeholders will benefit from the collected data in order to take comprehensive and accurate decisions.

A. Examples of projects based on local building cultures

Below are two examples that illustrate the **reinterpretation and the valorization of traditional architectural features** in economical habitats to reduce their vulnerability towards local hazards.

Example 1

1 The roof is anchored to the upper part of the wall.

2 The serrated fascia board breaks the wind flow in case of strong winds thus preventing the roof from blowing off.

3 The upper part of the gable end wall is built in wood thus limiting the risk of collapse of this highly vulnerable part in case of earthquake.

4 Timber bands bind the whole building and strengthen the walls towards out-of-plane lateral forces. They increase energy dissipation by friction and prevent cracks spreading.

Example 2

1 The risk of blowing off of the roof in case of strong winds is reduced thanks to its 4 slopes. Moreover, the large overhanging elements protect the walls by diverting the water away.

2 In case of strong winds, the perforated panels contributes to decreasing excessive pressures inside the building thus reducing the risk of blowing off of the roof.

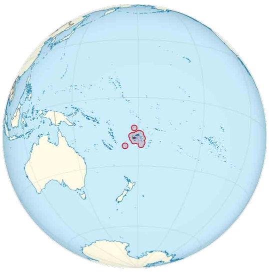
3 Having at least two doors per room is a strong local architectural feature. It allows a quick evacuation in case the main door is blocked.

4 Cross bracing improves the building resistance towards lateral forces (earthquake, cyclones).

2. Country profile

2.1. General description

A. Location



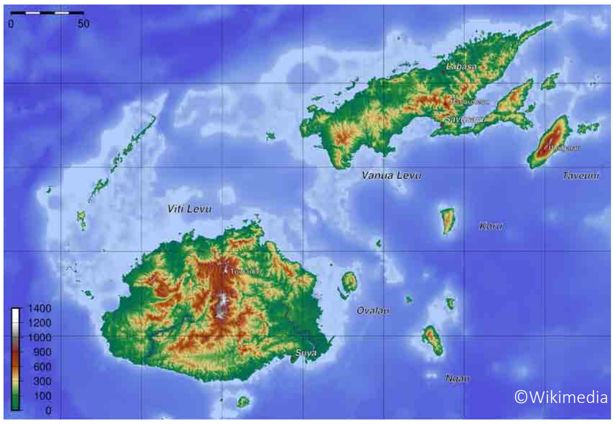
15-20 S - 176 E-178 W

B. Physical and topographical data

Area: 18,274 km2.

Relief : Fiji consists of 332 usually mountainous islands and 522 smaller islets.

Altitude : 0- 1,324 m.



Topography map.

C. Climate

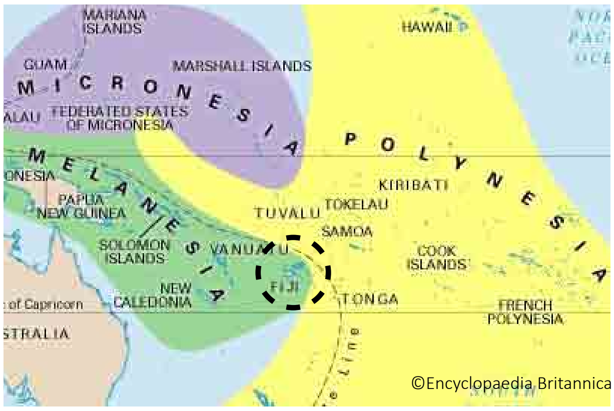
Climate: Tropical marine with slight seasonal temperature variations.

Rainfall per year: from 1500mm to 6000 mm.

Rainy season & South-Pacific Cyclone seasons: November to April.

D. Administrative data

Fiji is divided into provinces which consist of several *tikina* (districts). Each *tikina* is made of several *koro* or villages.



Map of culture areas in the Pacific Islands.

2.2. Demographic data

A. Population

Total: 909,389

Urban population: 53.7%

Rural population: 46.3%

Urban population growth: 1.45% annual rate

Population density: 48.2 people/km²

Life expectancy: 70.26 years

Fertility rate: 2.54 births per woman

Age structure:

- 0-14 years: 27.88%
- 15-24 years: 16.42%
- 25-54 years: 41.11%
- 55-64 years: 8.29%
- 65 years and over: 6.31%

B. Ethnic groups

iTaukei (native Fijians): 56.8%

Indian: 37.5%

Rotuman: 1.2%

Others: 4.5%

Data from CIA World Factbook and World Bank. and Preventionweb.

To go further

- CIA world factbook
  https://www.cia.gov/library/publications/the-world-factbook/geos/fj.html
- World bank
  https://data.worldbank.org/country/fiji

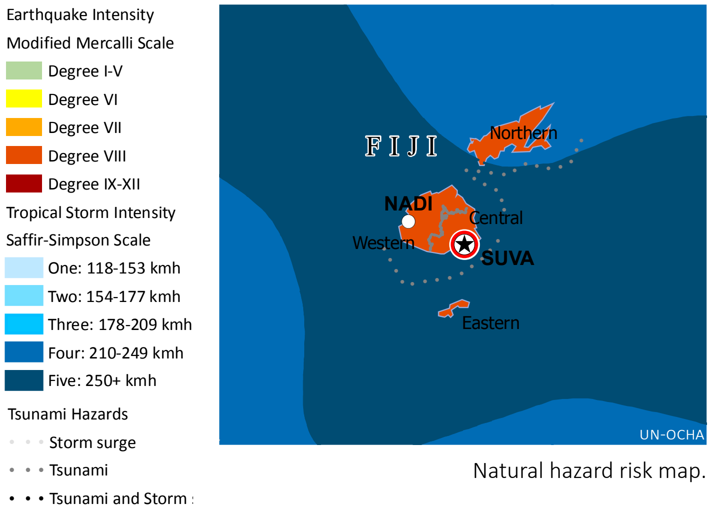
2.3. NATURAL HAZARDS

A. GENERAL DESCRIPTION

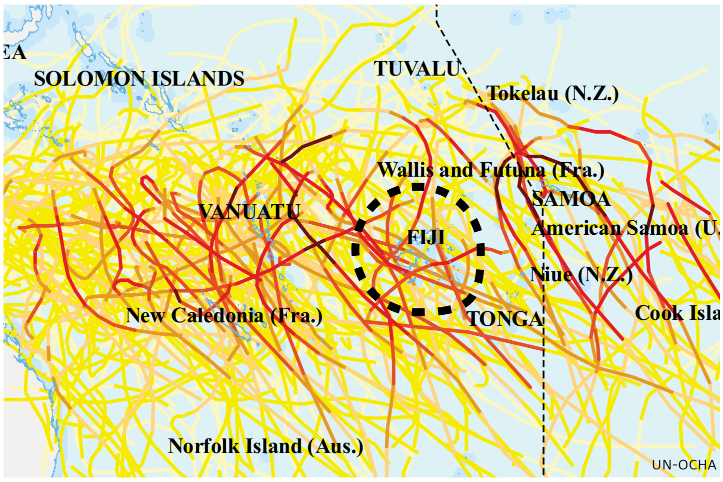
- ☑ CYCLONES & STRONG WINDS
- ☑ EARTHQUAKES
- ☑ FLOODS
- ☑ TSUNAMI & STORM SURGES
- ☐ OTHER:

NOTE : Cyclones are the most recurrent and devasting hazards.

Data from Preventionweb.



Natural hazard risk map.



Storm tracks 1956-2006.

B. HISTORY OF DISASTERS (21ST CENTURY)

2001

- **Severe Tropical Cyclone Paula.** February 25-March 4.

2002

- **Severe Tropical Cyclone Zoe**. December.

2003

- **Tropical Cyclone Cilla**. January 26-30.

2004

- **Tropical Depression 10F**. April 5.

2007

- **Flood and tropical Cyclone Cliff.** April 1-6.
- **Severe Tropical Cyclone Daman**. December 2-10.

2008

- **Severe Tropical Cyclone Gene.** January 26-February 9.

2009

- **Flash floods.** January 8-16.
- **Tropical Cyclone Mick**. December 13-16.

2010

- **Severe Tropical Cyclone Tomas.** March 12-16.

2011

- **Tropical Cyclone Vania.** January 5-18.

2012

- **Floods.** January 22-February 19.
- **Tropical Cyclone Evan.** December.

2013

- **Severe Tropical Cyclone Ami**. January 9-15.

2014

- **Cyclone Ian.** January 2-15.
- **Severe Tropical Cyclone Lusi.** March 7-16.

2015

- **Severe Tropical Cyclone Ula.** December**.**

2016

- **Severe Tropical Cyclone Winston.** February 7-26.
- **Severe Tropical Cyclone Amos.** April 13-20.

Sources: National Disaster Management Office Fiji, Wikipedia

TO GO FURTHER

GLOBAL RISK DATA PLATFORM

http://preview.grid.unep.ch/

3. General recommendations

3.1. Project management

Taking into account local knowledge and know-how on traditional disaster-resistant practices contributes to communities' resilience while strengthening their identities and self-reliance. This approach induces **specific actions that one should plan from the very beginning of the project.**

- **Field surveys** are necessary to identify the strengths and weaknesses of local building practices, as soon as possible after the catastrophe.
- **Cultural references** may defer a lot between the different actors. It is important to acknowledge this diversity of means of expression. Everyone should go beyond one's own **prejudices and stereotypes** and be open-minded and enthusiastic.
- **Inhabitants and local professionals are to be part of the project** as a source of information and as the keeper of the knowledge highlighted or rediscovered during the project. Moreover, the **different authorities** must be identified and met to make sure the project is in tune with their dynamics.
- **The project pedagogical aspects** are of high importance. Whatever the project technical quality may be, it is useful to recognize and exchange on its strengths and weaknesses with the inhabitants and local professionals. It improves everyone's technical proficiencies and on the long run, it allows for appropriate maintenance and modifications of the house according to inhabitants needs and capacities.
- **The project must be coordinated with complementary projects**. For example, a project relying on timber to build houses frames should be coordinated to reforestation projects – even if wood is imported during the project first phases.
- Indicators are needed for the project monitoring and assessment. It may be the number of jobs created locally or the money locally invested or the number of direct and non-direct beneficiaries. **The definition of such indicators and the means to reliably follow them up on a regular basis are to be planned in advance.**

3.2. Project implementation

- Carefully select the construction site to **avoid risky areas**: identification of the flood-prone areas, topographical study of the site, exposure to landslides etc.
- In the aftermath of a catastrophe, the lack of **access to drinking water and purification services** is often one of the major issues and should be integrated to any habitat project. **Waste disposal** should also be part of the project on an individual basis (house/family) or a collective one (village/community).
- In order to improve rural communities' resilience, habitat projects should include technical, social, cultural and economic aspects; for example to define a **house orientation and its position/ distance to the other houses** in the compound, the **size and location of outdoors spaces** (often used as food-producing gardens or for domestic or professional activities), the **landscaping** of the different areas (thermal benefits, water management, vegetal cyclone barrier).
- The habitat location must comply with **business activities areas** and **access to basic services** (job, education, health, energy) obligations.

To go further

On project management and field surveys:

- Assessing local building cultures, a practical guide for community-based assessment (Caïmi, 2015)

  https://hal.archives-ouvertes.fr/hal-01493386/file/16059_Caimi_Assessing_local_building.pdf

Self-assessment sustainability tool focused on shelter and settlement reconstruction in the aftermath of natural disasters:

- QSAND tool

  http://www.qsand.org/

Sustainable Housing Design Tool to assist housing practitioners in designing exemplary socially and culturally responsive, climate-resilient and economically sustainable housing projects:

- SHERPA tool

  https://unhabitat.org/sherpa/

3. General recommendations

3.3. Architectural design

- It is essential to identify the traditional **habitat organization and its conditions of use**: the household composition, the spaces policy of uses and partitioning, the graduation between the private areas and the public ones etc.
- The desired **building lifespan** varies a lot with the different communities. **Durability** aspects must be defined with regards to **dismantling** and **reuse** ones.
- The building systems should be **flexible** enough so that inhabitants can develop **belonging processes** and can **make it evolve** all along its lifespan according to their needs and abilities.
- Traditional construction processes are often the opportunity of crucial **interactions regarding social cohesion**. Beware of not weakening them and even try to strengthen them as far as possible.

3.4. Construction

- Several building elements must be implemented with a **specific care**:
    - The **anchorage** of the roof and the walls to the foundations,
    - The structure **bracing** devices,
    - The water-resistant **plinth** and/or the **posts ends** protection,
    - The water-resistant **treatment of walls** (plastering, grouting),
    - The **aseismic elements** (for example bracing elements or timber seismic bands in load-bearing stone masonry walls).
- **"Light" houses** often suffer much damage in case of a cyclone or an earthquake, but the **economic impacts and the casualties** are usually **less severe** than when a "heavy" house collapses.
- The materials and the connections should allow for a **reuse** or a **recycling**.
- It is important to get people sensitive to **regular maintenance**, especially after the rainy season or the cyclone season, as it significantly reduces damage.

4. Access to habitat

4.1. Tenure issues

More than 80% of the land is registered by the land owning unit (mataqali / clan) of Indigenous Fijians while the others include State hold, freehold land and leases.

In the past decades, an **important migration from rural to urban areas** has been registered, leading to several **squatter settlements** located in risk-prone areas. Settlement refers to place of residence on lease, owned land, or at will apart from villages.

TO GO FURTHER

FAO

http://www.fao.org/countryprofiles/index/en/?iso3=FJI

Wooden habitat: partial damage after 2016 cyclone Winston.

5. Intelligences of local habitat

5.1. Local habitat

A. Local affordable or self-built housing & construction types

Existing housing can be subdivided according to various quality and materials used. Low-cost and/or owner-built houses can be classified into one of the three categories: **vernacular**, **precarious** or **resulting from global influences**.

According to recent census, **only a very limited portion of the population is actually living in vernacular housing**, so-called *bure*. Most of the families live in “temporary” (lean-to, *vale vkakenani*) and “permanent” (bungalows, *vale tudei*) dwellings.

Building materials for the precarious and globalized types **must be imported** in significant quantities from outside the country and then shipped from distribution points. This increases the **overall cost** and can result in **long waiting periods** before a house can be assembled. This situation is further exacerbated in the aftermath of a disaster increasing recovery time and costs.

Vernacular housing:
lightweight flexible construction and 4-slope hipped roof for better wind resistance.

Precarious sheet housing:
elevation on stilts for better protection from floods.

Formal low-cost housing result of global influences:
cement block masonry with anchoring for roof structure.

B. Habitat organization and conditions of uses

Generally, vernacular and precarious houses have **external kitchens** in a detached small building and **pit-toilet** located outside.

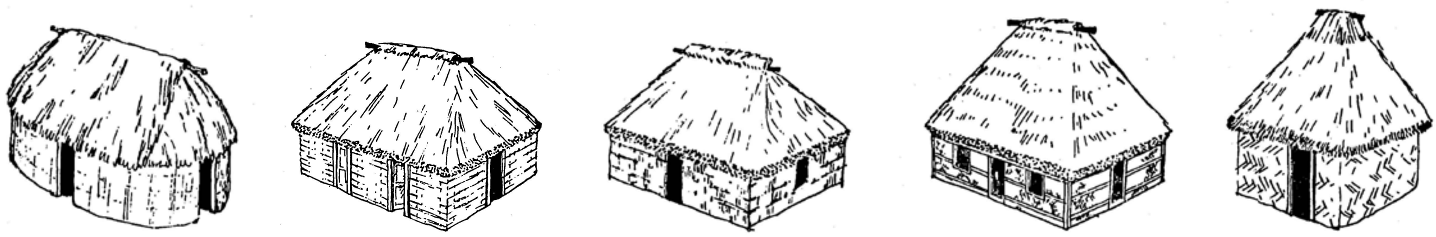
Additional buildings are usually much less sturdily built than the homes. They are frequently almost totally wiped out during cyclones and earthquakes. **Flying debris** from the structures (occasionally even the entire units become airborne) often causes sever damage to houses that might otherwise have weathered the storm.

5.2. Intelligences of vernacular habitat

A. General description and location

Fijian traditional housing is often referred as *vale vaka-viti* (Fijian's house) or *bure* in present days, although originally *bure* meant men's house.

This type of house is still found in **large numbers throughout the country**, with a great **variety of shapes, architectural styles and materials used**. These **one-room thatched houses** are particularly **well adapted to the local climate and environment**. They are **comfortable**, **inexpensive to build and maintain**, and often display great **craftsmanship** and **woodworking skills** in their construction.



Various types of traditional housing across the country.
©Intertect

B. Technical description

Structure

<u>Foundations</u>
Platform of large boulders and earth raised from a foot up to 3 or more feet from the ground.

Internal floor is covered with coconut leaf mats.

<u>Main structure</u>
Strong corner posts and wall posts from hardwood round timber set in the ground before the construction of the stone platform.

<u>Roof</u>
A wooden roof frame erected on top of the posts lashed together by coconut fibre ropes and covered by a thatch made from grass (*pandanus*) or other palm leaves stitched together and laid in sections overlapping one another.

In recent years, many thatched roofs have been replaced by corrugated iron (C.I.) sheets.

<u>Walls</u>
Mats made of woven bamboo or reeds are attached on the external side of the posts, often supported by small vertical posts to reinforce the walls in the centre.

In some areas, grass thatch walls are also used.

<u>Connections</u>
Traditionally, the house is bound together with ropes made from coconut fibre (*magimagi*) or other natural materials.

Traditional house: woven mat walls are fixed on the outside with additional wood elements to improve resistance to wind pressure; the top of the roof is reinforced with an additional layer of special grass tied to a timber beam protrunding from two sides of the roof.

A net of woven reeds is applied on the rafters to better fix the thatching.

C. Construction process

- The relatively narrow width decreases structural spans and the need for heavy structural members, making it **easier to carry out the works**.
- For a medium size bure, it takes about 2 weeks for the material collection and 4 weeks for the construction with 8 men and the master carpenter.
- Vernacular housing construction was always carried out by the collective work of village people. It began with a person who wished to construct a new one or to re-thatch the roof conveying the request to the chief who was in charge of organizing village meetings to discuss whether the construction was necessary. **Once the village people agreed, they decided who was involved and what tasks each had.**
- Materials used for vernacular housing are obtained in nearby areas. The carpenters and fellow members have an **extensive knowledge on location and availability of resources**.
- The 200 years old village of Navala, situated in the Nausori Highlands, **still maintains today its traditional way of building and living** as a result of the decision by the village committee.

- Housing with newly introduced materials and styles replaced vernacular construction in villages in the latter half of the 20th century. **It is hardly practiced in most villages, however, there are still elderlies who have traditional knowledge and skills.**
- In recent years there has been a general **decline in the level and quality of building skills** that is evident in the damage levels observed after recent cyclones.

D. Hazard-resistant practices

- **Settlement pattern** with scattered buildings and **vegetation belts** contribute to breaking the wind flow thus reducing its impact on construction.
- Traditional roofs usually have a 45° hipped **aerodynamic shape**.
- **Steep slope** of the roof allows for a **quick evacuation of rain water away** from the house, improving durability of thatching.
- **Eaves** are only a few inches wide thus **reducing uplift** and risk of damage to the roof under strong winds.
- The **house elevation** on mounds protects from flooding and storm surges.
- **Stones** are placed all around the elevated mounds filled with soil to **protect from erosion**.
- **Strong hardwood corner posts** are buried sufficiently to resist uplift.
- The lightweight and rope tying provides **ductility** and the **ability of bending and swaying without collapsing** to the structure during cyclones and earthquakes.

Housing construction with the involvement of the community.

Construction with mixed materials: even if heavily affected, its lightweight limits risks of serious injury.

Elevated stone platform for protection from floods and soil erosion. Small eaves and steep roof for reduced vulnerability and improved durability.

Coconut fibre tying for roof trusses (left) and corner post-ring beam (right).

- **Round shapes gables** improve wind resistance.
- Even though extensive structural damage may result from cyclones, **a total collapse of the bure is rarely life-threatening** as they are lightweight structures and, as they are woven together, components will not fly off to cause major harm.

- Modifications to bure construction, such as the use of nails, iron roofing and the reduced use of some traditional hardwoods because of their limited availability, render **many recently built bure more vulnerable**.
- Roofs that were traditionally bound together and to the main frame of the building are now **nailed**, with a **dramatic loss in strength**.
- **Possible lack of rigidity and bracing** of the structural frame.
- Possible lack of stability of the overall structure if the **base of the posts is rotten**.
- The primary causes of structural failure are generally:
    - separation of the roof from the walls caused by uplift and **failure of the connections** between the roof and walls;
    - collapse of the walls resulting from **lack of rigidity** in the centre portion of the wall;
    - failure of the corner post due to **deterioration of the wood** in the ground.

E. Green design & comfort features

- **Improved ventilation** thanks to the elevated floor, the reduced width of the house and a high thatched roof.
- The thickness of the walls varies according to climate. In dry areas rows of reeds are lashed together and form a **screen** which allows ventilation. In wet areas this screen is lined with thatch on the outside.
- Houses were built with open frames with generally no interior subdivision. Control of privacy, security, wind, and wind-blown rain are provided with **lightweight moveable screen elements**.

- Houses are dark and dim as **no windows** are provided to reduce the strong outside light and to keep a cool indoor temperature.

F. Lifespan & maintenance

- The **hot and damp climate** limits the durability of the buildings to approximately 20 years. However, if well constructed it may last for 30 to 40 years.
- A particular types of reeds are tied together to **thicken the topmost part of roof thatching**.

Scattered houses and tree barrier for reduced vulnerability to wind.

House damaged by a cyclone: a large quantity of materials can be reused for repair the existing house or to built a new one.

CI sheet *bure* after cyclone Winston: even if some have been damaged, they have resisted better than other constructions.

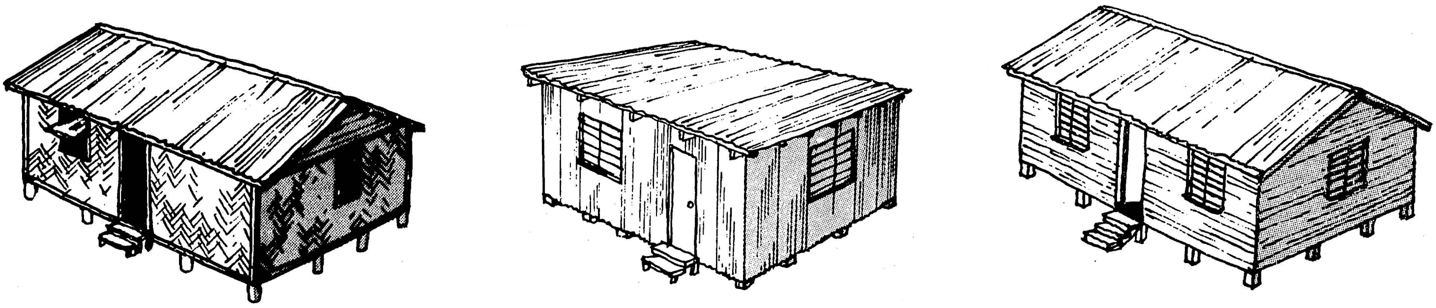
Bure built using CI sheets as evolution of the traditional building practices: round shape for improved aerodynamism.

5.3. Intelligences of precarious habitat

A. General description and location

Transitional houses are temporary or interim structures erected by families until they can afford more formal houses. In addition to the type of materials used, a usual criteria to determining if a house is formal or transitional is by whether or not it has interior running water and sanitary facilities.

Transitional houses are the **most vulnerable type of buildings**, frequently adopted by squatters to whom lack of title to land is a disincentive to make improvements, and by people living from subsistence farming in rural areas whose limited cash income does not allow to make many improvements on housing.



Wall types of transitional timber-framed housing (from left to right): with woven mats, CI sheets and timber boards.
©Intertect

B. Technical description

Structure

Timber-framed house: the elevated floor protects from soil humidity.

<u>Foundations</u>
None or in some cases short concrete piers.

<u>Main structure</u>
Saw timber frame with elevated wooden platform

<u>Roof</u>
1-side sloping or 2-side gabled roof covered with CI sheets and more rarely with *pandanus* thatch.

<u>Walls</u>
Palm or bamboo woven mats, CI sheets, timber boards

<u>Connections</u>
Nails

C. Construction process

- These houses can be built **very quickly** in a matter of a day or two with **extensions made over time**.
- In squatter dwellings, **materials** usually come from former houses and wood is collected from the nearby timber mills or “borrowed” through relatives and friends.
- Thanks to their lightweight they can be **easily moved**.

!

- Wood frame houses were in the past affordable to almost all income groups. In the last decades, because of the **cost of lumber**, this type of house has become almost as expensive as a cement block and steel house.

CI sheet house: tilting shutters can be easily fixed during cyclones.

D. Hazard-resistant practices

- Construction are raised on **stilts** as a protection from floods, coastal erosion and sea level rise.
- Large **corner posts are anchored to the ground** providing enough strength to hold down the building during strong winds.
- **Corner bracing** is sometimes used to improve the strength of the structure.
- **Flexible materials and lightweight structures** can sway and bend during earthquakes with reduced risk of injury in case of collapse.

- Sometimes, there is some provision for anchoring the frame to the concrete pier, but **usually the building simply rests on the posts greatly increasing the vulnerability of the whole house** that can be lifted off and toppled over during cyclones or slip from the piers during earthquakes.
- **Corrugated iron sheets** if poorly attached to wooden frames (nails frequently too short) can **fly away** and cause **serious injuries and damage** during cyclones.
- **Weak connection of walls to the frame**, especially in the corners, can cause walls separation and "box explosion" under strong winds.
- Low angled, gabled roofs with **large overhanging caves** are very vulnerable to strong winds.

E. Green design and comfort features

- **Woven mat walls** improve ventilation as air can pass through.
- **Tilting wooden shutters** protect from sunlight while ensuring cross ventilation.
- The **elevated platform** allow for an increased ventilation and a better protection from ground moisture.

- **CGI sheets** considerably increase heat inside.

F. Lifespan & maintenance

- **Woven mats** if properly maintained can last for many years and can be upgraded by replacing them with boards.
- An **elevation of the posts base** allows for a better protection from moisture and and increased durability.

4-slope CI sheet roof for reduced vulnerability to wind.

Elevation of the house above ordinary flood level.

Even if other vulnerabilities have led to serious damages, corner bracing under the platform is an important feature to improve the house stability.

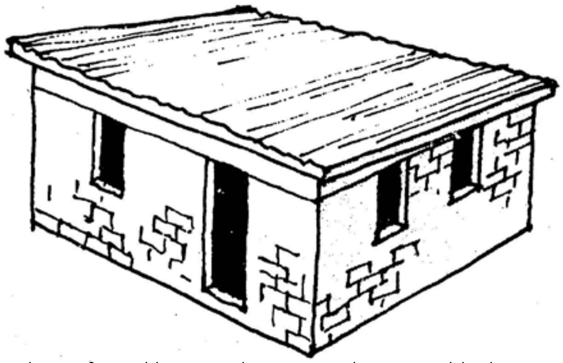
"Box explosion" under wind pressure due to weak connection between walls. Lack of anchoring between the corner posts and the concrete foundations.

5.4. Intelligences of habitat resulting from global influences

A. General description and location

Owner-built and government-subsided housing consists of a variety of **concrete block and more formal wooden frame structures**.

In addition, this category also includes government-aided housing often built after a disaster using a variety of **prefabricated panel** systems transported to the affected areas and erected on site.



Ordinary formal low-cost housing with cement block masonry.
©Intertect

B. Technical description

Structure

Foundations
Cement block wall, cement foundations

Main structure
Cement block masonry walls unreinforced or reinforced with steel rods; wooden frame

Roof
1 sloping, gabled or hipped roof
Timber structure with CI sheet covering

Walls
Cement blocks; timber boards

Connections
Steel rods, nails

Poor quality cement block masonry house with steel rods.

C. Hazard-resistant practices

- If properly built, a concrete block house is **resistant to earthquakes and windstorms**.
- **Connection of the roof structure to the masonry walls:**
  - A portion of the steel rods used in the reinforcing columns is left protruding out of the ring beam. A board plate is laid on the top of the ringbeam with a hole drilled for the rod to pass through. The rod is bent over to hold the plate down. The roof trusses are then attached to the plate.
  - Bolts are imbedded in the cement when the ring beam is poured. The plate is then attached by bolting it down.

- **If improperly built and reinforced, this type of construction is the most dangerous.** Damage caused by the wind pushing against an unreinforced or poorly reinforced wall can cause collapse due to excessive wind pressure on the outer surface of the wall. Total or partial collapse can cause serious and deadly injuries due to the weight of cement blocks.

Formal timber-framed house on cement block plinth.

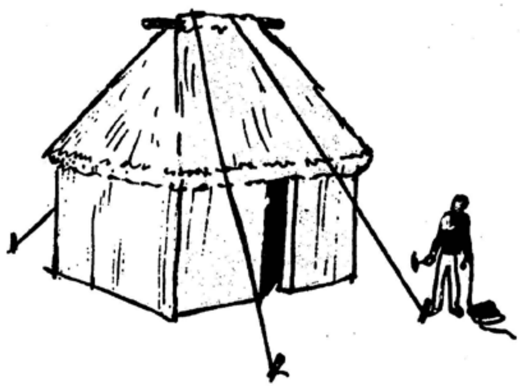
©Ravai Vafo'ou

Government-subsided low-cost housing.

6. Sociocultural practices fostering resilience

6.1. Community cooperation

- The chief's house was traditionally used as the evacuation centre and recent assessments reported that *bures* are still today often used as **communal shelters during cyclones**.
- From the onset of disasters, most communities display considerable cohesion as members provide **mutual assistance**: for instance for cleaning up of debris and putting the village back into a liveable condition, sharing of meagre resources.
- Where there was widespread destruction, **building materials** (reeds, *pandanus*, or bamboo) may have **become scarce**, but **access to them through inter-community linkages** was undoubtedly a common occurrence.
- Community cooperation was a key to post-disaster recovery: affected households could stay with other communities while recovering and **non-affected communities could assist affected communities** in the recovery process, bringing foods and building materials.
- Following a disaster, many affected households have arranged their own **repairs** through **voluntary involvement of family and local communities**, instead of deferring the repair works until the arrival of some form of government or civil society assistance.



Using rope to anchor the house and the roof to the ground.
©Intertect

Using woven leaves for improved protection of the walls and for additional closure of the openings.
©Intertect

6.2. Specific preparedness or post-disaster practices

Technical practices

- Different preparedness practices secure and stabilize the building or some of its parts:
  - **Roofs and windows** are secured by tying together the ends of two dry coconut leaves and laying them over the roof, with the heavy base hanging downwards.
  - The **roof** is tied down with ropes and fastened to large sturdy trees.
  - Banana leave veins woven and tied with green coconut leaves are used to **cover thatched roofs** to protect them.
  - Tyres, heavy cement bricks and sandbags are placed onto **CGI sheet roof** to prevent them from blowing off.
  - Cutting of **big trees** near the house.
- When the traditionally tied lightweight houses collapse, in case cyclones or earthquakes are stronger than their capacity to withstand, the occupants are not severely injured and **a new structure can be quickly and easily rebuilt using materials available from the former house**.
- During cyclones, ***bure* roofs are often removed** and placed on the ground nearby. Thanks to their shape they provide a very **safe and stable temporary shelter** for the people who crawl underneath and sit upon the rafters.
- During floods, some communities live on **shelves strung on the rafters**, diving in and out of the door. They **cook and move around on rafts** of bamboo and banana stems.
- Fijians traditionally prepared for each hurricane season by **propping up and tying down houses on the month of October**, when the season of storms and cyclones is supposed to start. Nowadays they usually wait for more immediate signs, or radio announcements; however, some practices for vulnerability reduction are still in use (for example, tying the roof structure to nerby sturdy trees).

6. Sociocultural practices fostering resilience

Traditional warning systems

- In rural villages, people know several **natural warning signs foretelling a cyclone**. Traditional effective practices - such as blowing the conch shell or beating wooden drums - are still used today to **issue disaster warnings** to complete modern technical methods.

Season calendar

- The **names of the months** refer to various natural phenomena. For instance, the period from March to May is known as the “rainy season” when heavy rains are expected while the period from December to February is often called “hot season” or also “sail-wrapping season” to indicate that sailling is not normally undertaken because of the danger of cyclones.

Famine crops & disaster-resistant food

- After crisis, communities were relatively self-sufficient in **food resources** thanks to their knowledge about comestible wild plants, the use of a wide range of plants able to resist to various natural hazards and supplementary crops - so-called “famine crops” - that were rarely consumed in time of plenty.
- Among traditional means of food preservation, particular cooking and drying processes were also used to prepare **long-lasting emergency reserves** that can be stored for 15 months without deterioration.
- In rural areas, crops were scattered in **different locations with different vulnerabilities** between species and sites to reduce the risk of a total devastation from extreme events.


©Reuters AAP

Tyres placed on CI sheet roof to reduce vulnerability to wind.


©AP

Residents boarding up windows as they prepare for 2016 cyclone Winston.

7. Additional resources

7.1. Regional and local stakeholders

NATIONAL AUTHORITIES & AGENCIES

- Housing Authority of Fiji: http://www.housing.com.fj
- Housing Assistance and Relief Trust HART, Fiji: http://hartfiji.com/
- Habitat for Humanity Fiji: http://www.habitatfiji.org.fj
- iTaukei Land Trust Board, Fiji: https://www.tltb.com.fj/

UNIVERSITIES & TRAINING CENTRES

- School of Building & Civil Engineer, Fiji National University: http://www.fnu.ac.fj/new/colleges/engineering-science-technology/school-of-building-civil-engineering
- University of the South-Pacific, Fiji: https://www.usp.ac.fj/
- School of Architecture, The University of Queensland, Australia: http://www.architecture.uq.edu.au/

COMPLEMENTARY RESOURCES

- Kalevu Cultural Centre, Sigatoka Town, Fiji: http://www.fiji.travel/us/activity/kalevu-cultural-centre
- Department of Heritage & Arts, Fiji Ministry of Education: http://www.culture.gov.fj
- Pacific Disaster Net: http://www.pacificdisaster.net

7.2. For further information

ADVOCACY FOR THE CONSIDERATION OF LOCAL BUILDING CULTURES IN DEVELOPMENT AND RECONSTRUCTION PROJECTS

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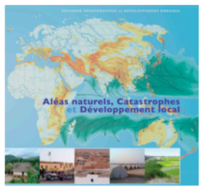
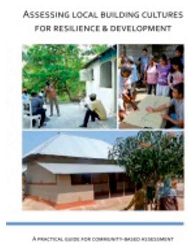


B

METHODOLOGICAL GUIDE FOR ASSESSING LOCAL BUILDING CULTURES FOR RESILIENCE AND DEVELOPMENT

- CRAterre, IFRC, 2015, Assessing local building cultures for resilience and development: A practical guide for community-based assessment. Villefontaine: CRAterre éditions (English, 121 pages). https://hal.archives-ouvertes.fr/hal-01493386/file/16059_Caimi_Assessing_local_building.pdf (Front page C)



C

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8. Reminder

Below is a short list of recommendations to guide you when designing or implementing a habitat project integrating local building cultures.

PROJECT MANAGEMENT

- Carry out a **field survey** as soon as possible to identify the strengths and weaknesses of local building practices and of local market.
- Identify and meet the different **authorities**.
- Include **inhabitants** and **local professionals** as much as possible into the project.
- Develop and insist on the **pedagogical aspects** of the projects.
- **Coordinate the project with complementary ones** to develop a comprehensive and integrated approach.
- Make sure the practices you promote are **financially and technically accessible** for most people to leverage the project impact.

IMPLEMENTATION

- **Carefully select the construction** site to avoid risky areas and comply with business activities areas and access to basic services obligations.
- Take into account **land tenure** issues.
- Plan for an easy access to **drinking water and sanitation services**.
- Carefully define the **orientation** and position of buildings and **public/private outdoors areas** into the compound, and the landscaping of the latter.

LOCAL HABITAT INTELLIGENCES

- Identify **local building practices** and know-how and **valorize** the ones that foster the inhabitants' **resilience**.
- Valorize local practices that contribute to an **ecological** and **comfortable habitat**.
- Plan for the building **maintenance** and repairs.
- Collect feedbacks from **previous projects**.

ARCHITECTURAL DESIGN AND CONDITIONS OF USE

- Identify the **composition of the household** and local practices in terms of cohabitation and uses of indoors and outdoors areas.
- Question the concepts of **durability**, dismantling and **reuse** with regards to local habits.
- Allow for a **flexibility** of the building system so that inhabitants can develop belonging processes and make it **evolve** all along its lifespan according to their needs and abilities.

CONSTRUCTION

- Carefully design and implement the **crucial building elements** regarding risk reduction: The anchorage of the roof and the walls to the foundations, the structure bracing devices, the water-resistant plinth and/or the posts ends protection, the protection of walls (plastering, grouting), the seismic bands etc.
- Select materials according to their **availability and accessibility** and check their **quality**.
- Select materials and connections in order to **ease their reuse or recycling**.
- Sensitize people about the importance of **regular maintenance** in DRR.

CONSTRUCTION PROCESS

- Beware of **climate constraints** and the **seasonal impacts** regarding materials and people availability.
- Analyse the **social aspects** of the building processes and their impacts on the community cohesion and the efficiency of works.

SOCIOCULTURAL PRACTICES FOSTERING RESILIENCE

- Analyse local practices regarding **community cooperation** in building sector and other sectors (for example agricultural activities).
- Identify local practices regarding **risk preparedness and recovery.**

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